



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/622,046	07/16/2003	Shenggao Liu	005950-833	2268
7590	06/13/2007	BURNS, DOANE, SWECKER & MATHIS, L.L.P. P.O. Box 1404 Alexandria, VA 22313-1404	EXAMINER LULIS, MICHAEL P	
			ART UNIT 2824	PAPER NUMBER
			MAIL DATE 06/13/2007	DELIVERY MODE PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary

Application No.	10/622,046	Applicant(s)	LIU ET AL.
Examiner	Michael Lulis	Art Unit	2824

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1) Responsive to communication(s) filed on 03 January 2007.
2a) This action is FINAL. 2b) This action is non-final.
3) Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4) Claim(s) 1-34 and 39-42 is/are pending in the application.
4a) Of the above claim(s) _____ is/are withdrawn from consideration.
5) Claim(s) _____ is/are allowed.
6) Claim(s) 1-9, 12-20, 23-34 and 39-42 is/are rejected.
7) Claim(s) 10, 11, 21, and 22 is/are objected to.
8) Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9) The specification is objected to by the Examiner.
10) The drawing(s) filed on 16 July 2003 is/are: a) accepted or b) objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
11) The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12) Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) All b) Some * c) None of:
1. Certified copies of the priority documents have been received.
2. Certified copies of the priority documents have been received in Application No. _____.
3. Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) Notice of References Cited (PTO-892)
2) Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date _____.
4) Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.
5) Notice of Informal Patent Application
6) Other: Search History.

DETAILED ACTION

1. In view of the appeal brief filed on 01/03/2007, PROSECUTION IS HEREBY REOPENED. New grounds of rejection are set forth below.

Response to Arguments

2. Applicant's arguments with respect to claims 1-34 and 39-42 have been considered but are moot in view of the new ground(s) of rejection.

Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

4. **Claims 1-9 and 12-20 are rejected under 35 U.S.C. 102(b) as being anticipated by Pastor (WO 88/02792).**

5. **Regarding claim 1,** Pastor discloses an n-type diamondoid (page 8 lines 15-20) material comprising an electron-donating heteroatom (page 7 lines 1-19).

6. **Regarding claim 2,** Pastor discloses the n-type diamondoid material of claim 1 (see above), wherein the electron-donating heteroatom is a group V element (page 7 lines 1-19).

7. **Regarding claim 3**, Pastor discloses the n-type diamondoid material of claim 1 (see above), wherein the electron-donating heteroatom is selected from the group consisting of nitrogen, phosphorus, and arsenic (page 7 lines 1-19).
8. **Regarding claim 4**, Pastor discloses the n-type diamondoid material of claim 1 (see above), wherein the material comprises an aza-diamondoid (page 7 lines 1-19).
9. **Regarding claim 5**, Pastor discloses the n-type diamondoid material of claim 1 (see above), wherein the electron-donating heteroatom occupies a substitutional site on the diamond lattice (page 7 lines 1-19).
10. **Regarding claim 6**, Pastor discloses the n-type diamondoid material of claim 1 (see above), wherein the electron-donating heteroatom is sp^3 -hybridized in the diamond lattice (page 7 lines 1-19).
11. **Regarding claim 7**, Pastor discloses the n-type diamondoid material of claim 1 (see above), wherein the diamondoid is selected from the group consisting of adamantane (page 8 lines 15-20), diamantane, and triamantane.
12. **Regarding claim 8**, Pastor discloses the n-type diamondoid material of claim 1 (see above), wherein the diamondoid is selected from the group (page 14 lines 15-25) consisting of tetramantane, pentamantane, hexamantane, heptamantane, octamantane, nonamantane, decamantane, and undecamantane.
13. **Regarding claim 9**, Pastor discloses the n-type diamondoid material of claim 1 (see above), wherein the material is a polymerized heterodiamondoid (pg 8 lines 15-20).
14. **Regarding claim 12**, Pastor discloses a p-type diamondoid (page 8 lines 15-20) material comprising an electron-withdrawing heteroatom (page 7 lines 1-19).

15. **Regarding claim 13**, Pastor discloses the p-type diamondoid material of claim 12 (see above), wherein the electron-withdrawing heteroatom is a group III element (page 7 lines 1-19).
16. **Regarding claim 14**, Pastor discloses the p-type diamondoid material of claim 12 (see above), wherein the electron-withdrawing heteroatom is selected from the group consisting of boron and aluminum (page 7 lines 1-19).
17. **Regarding claim 15**, Pastor discloses the p-type diamondoid material of claim 12 (see above), wherein the material comprises an boro-diamondoid (page 7 lines 1-19).
18. **Regarding claim 16**, Pastor discloses the p-type diamondoid material of claim 12 (see above), wherein the electron withdrawing heteroatom occupies a substitutional site on the diamond lattice (page 7 lines 1-19).
19. **Regarding claim 17**, Pastor discloses the p-type diamondoid material of claim 12 (see above), wherein the electron withdrawing heteroatom is sp^3 -hybridized in the diamond lattice (page 7 lines 1-19).
20. **Regarding claim 18**, Pastor discloses the p-type diamondoid material of claim 12 (see above), wherein the diamondoid is selected from the group consisting of adamantane (page 8 lines 15-20), diamantane, and triamantane.
21. **Regarding claim 19**, Pastor discloses the p-type diamondoid material of claim 12 (see above), wherein the diamondoid is selected from the group (page 14 lines 15-25) consisting of tetramantane, pentamantane, hexamantane, heptamantane, octamantane, nonamantane, decamantane, and undecamantane.

22. **Regarding claim 20**, Pastor discloses the p-type diamondoid material of claim 12 (see above), wherein the material is a polymerized heterodiamondoid (page 8 lines 15-20).

Claim Rejections - 35 USC § 103

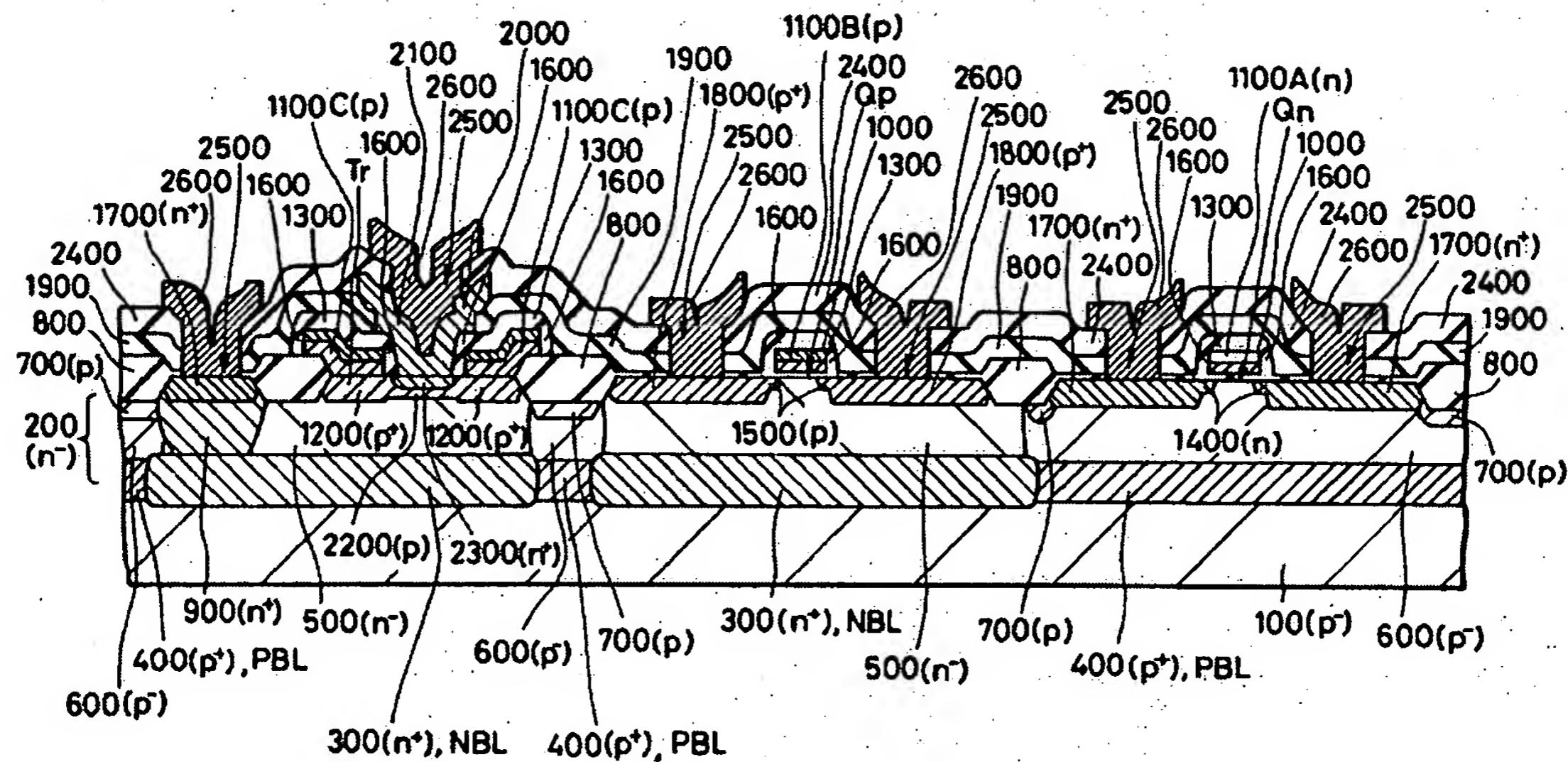
23. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

24. **Claims 23-34 are rejected under 35 U.S.C. 103(a) as being unpatentable over Pastor (WO 88/02792) in view of Ikeda et al. (US 5057894).**

25. **Regarding claim 23**, Pastor discloses a p-type diamondoid material and an n-type diamondoid material (page 7 lines 1-15 and page 8 lines 15-20). Pastor is silent with respect to a particular device in which the materials are to be used. Ikeda et al. teaches the use of p-type and n-type materials in a p-n junction (for example, figure 13, between 1700 and 600). Pastor and Ikeda et al. are analogous art because they are from the same field of endeavor, semiconductor devices. It would have been obvious at the time of invention to a person of ordinary skill in the art to use the p-type diamondoid material and an n-type diamondoid material of Pastor in a device having a p-n junction. The motivation would have been to employ the materials in a useful device.

FIG. 13



Ikeda et al. Figure 13

26. **Regarding claim 24,** it would have been obvious at the time of invention to a person of ordinary skill in the art to combine Pastor and Ikeda et al. to yield the p-n junction of claim 23 (see above), wherein the n-type diamondoid material is aza-heterodiamondoid (Pastor page 7 lines 1-19).
27. **Regarding claim 25,** it would have been obvious at the time of invention to a person of ordinary skill in the art to combine Pastor and Ikeda et al. to yield the p-n junction of claim 23 (see above), wherein the n-type diamondoid material is phospho-heterodiamondoid (Pastor page 7 lines 1-19).
28. **Regarding claim 26,** it would have been obvious at the time of invention to a person of ordinary skill in the art to combine Pastor and Ikeda et al. to yield the p-n

junction of claim 23 (see above), wherein the p-type diamondoid material is boro-heterodiamondoid (Pastor page 7 lines 1-19).

29. **Regarding claim 27**, Pastor discloses an n-type heterodiamondoid material and a p-type diamondoid material (page 7 lines 1-19 and page 8 lines 15-20). Pastor is silent with respect to a particular device in which the materials are to be used. Ikeda et al. teaches the use of n-type and p-type materials in a transistor (figure 13). Pastor and Ikeda et al. are analogous art because they are from the same field of endeavor, semiconductor devices. It would have been obvious at the time of invention to a person of ordinary skill in the art to use the n-type heterodiamondoid material and p-type diamondoid material of Pastor in a transistor. The motivation would have been to employ the materials in a useful device.

30. **Regarding claim 28**, it would have been obvious at the time of invention to a person of ordinary skill in the art to combine Pastor and Ikeda et al. to yield the diamondoid transistor of claim 27 (see above). Pastor is silent with respect to a particular device in which the materials are to be used. Ikeda et al. teaches the use of n-type and p-type materials in an n-p-n field effect transistor (figure 13, 600 and 1400). Pastor and Ikeda et al. are analogous art because they are from the same field of endeavor, semiconductor devices. It would have been obvious at the time of invention to a person of ordinary skill in the art to use the n-type heterodiamondoid material and p-type diamondoid material of Pastor in a n-p-n field effect transistor. The motivation would have been to employ the materials in a useful device.

31. **Regarding claim 29**, it would have been obvious at the time of invention to a person of ordinary skill in the art to combine Pastor and Ikeda et al. to yield the diamondoid transistor of claim 27 (see above). Pastor is silent with respect to a particular device in which the materials are to be used. Ikeda et al. teaches the use of p-type and n-type materials in an p-n-p field effect transistor (figure 13, 500 and 1500). Pastor and Ikeda et al. are analogous art because they are from the same field of endeavor, semiconductor devices. It would have been obvious at the time of invention to a person of ordinary skill in the art to use the p-type diamondoid material and the n-type heterodiamondoid material of Pastor, in combination with Benison et al., in a p-n-p field effect transistor. The motivation would have been to employ the materials in a useful device.

32. **Regarding claim 30**, it would have been obvious at the time of invention to a person of ordinary skill in the art to combine Pastor and Ikeda et al. to yield the diamondoid transistor of claim 27 (see above), wherein the n-type diamondoid material is aza-heterodiamondoid (Pastor page 7 lines 1-19).

33. **Regarding claim 31**, it would have been obvious at the time of invention to a person of ordinary skill in the art to combine Pastor and Ikeda et al. to yield the diamondoid transistor of claim 27 (see above), wherein the n-type diamondoid material is phospho-heterodiamondoid (Pastor page 7 lines 1-19).

34. **Regarding claim 32**, it would have been obvious at the time of invention to a person of ordinary skill in the art to combine Pastor and Ikeda et al. to yield the

diamondoid transistor of claim 27 (see above), wherein the p-type diamondoid material is boro-heterodiamondoid (Pastor page 7 lines 1-19).

35. **Regarding claim 33**, it would have been obvious at the time of invention to a person of ordinary skill in the art to combine Pastor and Ikeda et al. to yield the diamondoid transistor of claim 27 (see above). Pastor is silent with respect to a particular device in which the materials are to be used. Ikeda et al. teaches the use of p-type and n-type materials in a transistor comprising a source, gate, and drain, wherein the source and drain are fabricated from the n-type material (figure 13, 1400), and the gate is fabricated from the p-type material (column 10 lines 50-65). Pastor and Ikeda et al. are analogous art because they are from the same field of endeavor, semiconductor devices. It would have been obvious at the time of invention to a person of ordinary skill in the art to use the p-type diamondoid material and the n-type heterodiamondoid material of Pastor in a transistor comprising a source, gate, and drain, wherein the source and drain are fabricated from the n-type material, and the gate is fabricated from the p-type material. The motivation would have been to employ the materials in a useful device.

36. **Regarding claim 34**, it would have been obvious at the time of invention to a person of ordinary skill in the art to combine Pastor and Ikeda et al. to yield the diamondoid transistor of claim 27 (see above). Pastor is silent with respect to a particular device in which the materials are to be used. Ikeda et al. teaches the use of p-type and n-type materials in a transistor comprising a source, gate, and drain, wherein the source and drain are fabricated from the p-type material (figure 13, 1500), and the

gate is fabricated from the n-type material (column 10 lines 50-65). Pastor and Ikeda et al. are analogous art because they are from the same field of endeavor, semiconductor devices. It would have been obvious at the time of invention to a person of ordinary skill in the art to use the p-type diamondoid material and the n-type heterodiamondoid material of Pastor in a transistor comprising a source, gate, and drain, wherein the source and drain are fabricated from the p-type material, and the gate is fabricated from the n-type material. The motivation would have been to employ the materials in a useful device

37. Claims 39-42 are rejected under 35 U.S.C. 103(a) as being unpatentable over Pastor (WO 88/02792) in view of Ikeda et al. (US 5057894) and in further view of Lau et al. (US 20020016414 A1).

38. Regarding claim 39, Pastor discloses n and p-type heterodiamondoid materials (page 7 lines 1-19 and page 8 lines 15-20). Pastor is silent with respect to a particular device in which the materials are to be used. Ikeda et al. teaches the use of n-type and p-type materials in a transistor (figure 13) comprising electrically conducting regions and electrically insulating regions. Pastor and Ikeda et al. are analogous art because they are from the same field of endeavor, semiconductor devices. It would have been obvious at the time of invention to a person of ordinary skill in the art to use the n and p-type heterodiamondoid material of Pastor in electrically conducting regions of a transistor. The motivation would have been to employ the materials in a useful device. Further, Pastor and Ikeda et al. do not disclose expressly the use of undoped diamondoid materials. Lau et al. teach the use of undoped diamondoid materials as

electrically insulating regions (para 0025). Pastor, Ikeda et al., and Lau et al. are analogous art, electronic materials and devices. It would have been obvious at the time of invention to a person of ordinary skill in the art to use the undoped diamondoid materials of Lau et al. as any insulator where a low dielectric constant is desirable in the transistor that is obvious over Pastor and Ikeda et al. The motivation for replacing most dielectrics and thereby forming a transistor comprising a substantially single material (diamondoid material) would have been to reduce parasitic capacitances.

39. **Regarding claim 40**, it would have been obvious at the time of invention to a person of ordinary skill in the art to combine Pastor, Ikeda et al., and Lau et al. to yield the transistor of claim 39 (see above), wherein the n-type diamondoid material comprises aza-heterodiamondoid (Pastor page 7 lines 1-19).

40. **Regarding claim 41**, it would have been obvious at the time of invention to a person of ordinary skill in the art to combine Pastor, Ikeda et al., and Lau et al. to yield the transistor of claim 39 (see above), wherein the n-type diamondoid material comprises phospho-heterodiamondoid (Pastor page 7 lines 1-19).

41. **Regarding claim 42**, it would have been obvious at the time of invention to a person of ordinary skill in the art to combine Pastor, Ikeda et al., and Lau et al. to yield the transistor of claim 39 (see above), wherein the p-type diamondoid material comprises boro-heterodiamondoid (Pastor page 7 lines 1-19).

Allowable Subject Matter

42. Claims 10, 11, 21, and 22 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. While polymerized heterodiamondoid material is known (see US 5019660), the prior art references of record, either alone or in combination, neither disclose nor suggest either n-type or p-type diamondoid material comprising an electron-donating heteroatom, wherein the material is a polymerized heterodiamondoid including a metal atom to enhance electrical conductivity.

Conclusion

When responding to this office action, applicants are advised to provide the examiner with the line numbers and page numbers in the application and/or references cited to assist the examiner in locating appropriate paragraphs.

A shortened statutory period for response to this action is set to expire three months and zero days from the date of this letter. Failure to respond within the period for response will cause this application to become abandoned (see MPEP 710.02(b)).

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Michael Lulis whose telephone number is (571) 272-9015. The examiner can normally be reached on 8:30 AM to 5:00 PM Monday through Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Richard Elms can be reached on (571) 272-1869. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

ML
05 June 2007

Tuan Nguyen

TUAN T. NGUYEN
PRIMARY EXAMINER

RE
RICHARD T. ELMS
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2800
6/1/07